TRAFFIC ENGINEERING

Vol. X MARCH, 1940 No. 11

THE ANALYSIS OF INTERSECTION ACCIDENTS

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THE Traffic Survey Manual of the Works Progress Administration states that the "worst corner list" shall include all intersections where four or more accidents occurred during the previous year. In a comparatively small city with poor accidenting practice, this list may be such a short one that the number of accidents for inclusion will have to be made less than four or the period covered must be made more than one year in order to have a reasonable number of locations to study. On the other hand, if this rule is used in a very large city with first class accident reporting, there may be hundreds of intersections on the "worst corner list." In one city, even when ten accidents were used as a minimum instead of four, there were nearly 300 "worst corners," and using four as a minimum the list might have included more than 1000 intersections.

Obviously when hundreds of locations are involved, all of them cannot be carefully investigated by the traffc engineering staff, at least not in any short period of time. As a matter of fact, in the majority of cases investigation may show nothing except that the intersection is a very busy one, and much time may be wasted trying to find a non-existent special accident cause.

From the standpoint of possible remediable hazards, the "worst corners" are not necessarily those having the largest number of accidents but those having the largest ratio of accidents to traffic volume. For instance, an intersection carrying only 2000 vehicles a day and having 16 accidents a year is approximately four times as hazardous as one carrying 50,300 vehicles a day and having 98 accidents a year. It is eight times as hazardous as one carrying 12,200 vehicles and having 12 accidents, and 16 times as bad as one with 18,700 vehicles and 9 accidents. These are all actual examples from a "worst corner list." The 2000-vehicle intersection had 5 injury accidents and another with 2200 vehicles had 6, or three injury accidents to each 1000 vehicles per day, while the 50,300-vehicle intersection had only 16 injury accidents, or less than 0.3 accidents per 1000 daily vehicles. From this standpoint the first intersection was ten times as hazardous as the second, although it had only about one-third as many injury accidents.

If any two intersections with similar traffic volumes have widely varying numbers of accidents, it seems evident that the one with more accidents is more likely to have a remediable hazard and warrants prior consideration.

When a "worst corner list" includes a large number of locations, a quick way to determine the comparative hazards is to make a chart with daily traffic volumes as abscissas and number of accidents as ordinates. Dots of different colors or shapes can be used to indicate injury and non-injury accidents, thus giving two dots for each intersection where injury accidents have occurred. Suppose there are

300 corners involved, and it is decided that about 50 will be investigated first. A line can then be drawn across the chart in such a way that the 50 most hazardous corners will be above the line. From the traffic volume and number of accidents it is comparatively easy to make a quick identification of each dot as to location.

Classification of Intersections

When an intersection is suffering from a traffic "disease" a good diagnostician can usually identify the trouble from the symptoms, even before he goes into the field. All traffic engineers are familiar with the use of collision diagrams, and may need no other information, but without considerable experience it is easy, in some cases, to be misled by superficial considerations.

I have found it desirable to make a list of the number and nature of accidents at each location, from the collision diagrams or accident reports, and then to classify the intersections according to the predominant type of accident, if any. One classification was as follows:

A—Safety zone crashes
B—Night accidents
C—Pedestrian accidents, mainly daytime
D—Right-angle collisions
E—Rear-end collisions
F—Left-hand accidents
G—No type of accident predominant

Sometimes whole streets, or sections of streets, can be classified in a similar way.

So far as I have been able to discover, it is only when studying an area, or considerable section of a street, that the location of fatal accidents has any particular significance, although they loom large in the public mind. The fatalities in a year may run into the hundreds without having two or more at the same intersection, or there may be one or more at a certain intersection in one year without any other fatality occurring there in a number of years, if ever.

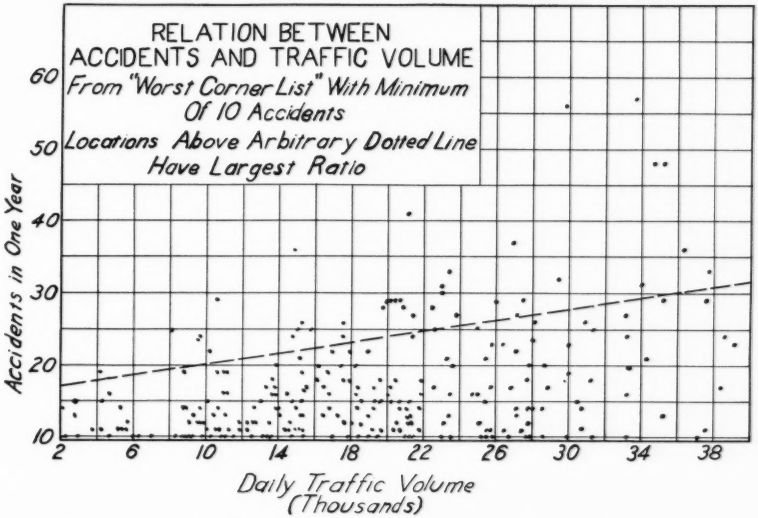
While it may not be true on high-speed rural roads, or at railroad crossings, on ordinary city streets the location of fatalities seems to be mainly a matter of chance. In a great many cases, whether the accident is to be recorded as injury or fatality depends upon whether the victim is allowed to lie on the pavements until an ambulance can take him to a hospital in a proper manner, or is folded up and stuffed into a passing car, with his broken ribs, for instance, ripping open his lungs, or other vital organs. Thousands of persons are probably killed that way who would recover if properly handled.

If two streets have approximately the same amount and character of traffic, but there are many more fatalities on one than on the other, then there is apt to be a definite reason for the difference, but if there are 5 injury accidents at Prune and Plum Sts., and 4 injuries and 1 fatality at Peach and Apricot Sts., I cannot see that it means anything at all from a traffic engineering standpoint.

In classifying "worst corners," therefore, it is well to record fatalities but not to get unduly excited about them. Fatal and injury accidents together, however, should be considered separately from non-injury accidents because some locations will rate high in injury accidents year after year while others, with more total accidents, will have fewer injuries. Obviously the former are more important, and higher speeds may be the reason for the difference.

Examples of Classification

In the following actual examples of intersections classified according to the predominant type of accident the term "intersection" is loosely interpreted



to include a considerable portion of the streets adjacent to the intersection.

CLASS A—Safety zone crashes predominant. Of 11 injury accidents and 18 total accidents nearly 2/3 were safety zone crashes, and the most obvious need was a flood-lighted striped shield on the approach end of the zone.

At another intersection in this class, of 12 safety zone crashes 9 involved east-bound vehicles and only 3 west-bound. A few hundred feet east the street was much narrower, so that the feeble safety zone lights blended with advertising signs on the narrow-street section. A field inspection at night immediately cleared up what at first seemed to be a rather mysterious situation in which the drunks went home more safely than they went to town.

CLASS B—Night accidents predominant. At this intersection 77% of the 13 injury accidents and 67% of the total accidents occurred at night, indicating that better street lighting was badly needed.

CLASS C — Pedestrian accidents; mainly daytime. At an intersection in the main downtown shopping district the special " hazard " which gave this corner a high accident-to-traffic volume ratio was the thousands of pedestrians crossing. Twenty-one out of 22 injury accidents involved pedestrians, and there were only 7 non-injury accidents of all kinds. In 10 of the accidents the pedestrians were clearly at fault, so that better pedestrian regulation and the need of pedestrian signals were indicated.

CLASS D — Right-angle collisions. At this intersection, carrying less than 4000 vehicles per day, there were 4 injury accidents and 13 non-injury accidents, all of which involved right-angle collisions. Eighty-eight per cent were at the southeast corner, the indication being that one stop sign and one slow sign were needed.

At another intersection in the same class there were exactly the same total number of accidents in two succeeding years, and the points of collision were rather evenly divided between the 4 corners. The need for 2 stop signs was evident.

Apparently in most cities the intersections with the highest accident ratios are light-traffic locations, and most of the accidents are right-angle collisions. This often leads to the erection of unwarranted traffic signals which tend to increase rather than decrease the accidents. In fact, at many such places the signal is the main cause of the accidents, since the drivers watch the signal instead of the traffic. One driver may be going too fast to stop when the signal changes, while the other starts on the amber without looking for possible vehicles on the cross street.

CLASS E—Rear-end collisions. At an intersection carrying nearly 34,000 vehicles per day there were 58 accidents of all kinds, exactly ½ of them being rear-end collisions. A police station is located at this corner and one police officer familiar with the situation gave it as his opinion that the rear-end collisions were due to better reporting than would be true if the police station were not there, while another officer thought that the collisions were due to the desire of drivers to avoid "running red lights" in front of the police station, and therefore making an unusually large number of quick stops. Actually the two streets intersected at an acute angle, and the signals, in order to be visible on the lighter volume street, were located 12 feet back of the curb on the main street, thus making them difficult to see and causing the many rear-end collisions.

Other situations often result in placing signals a considerable distance back of curb lines and, so far as my observations go, this always results in a large number of rear-end collisions. Taking it the other way, an excess of rear-end collisions practically always means that signals are obscured in some way, possibly by branches or posts.

CLASS F—Left turning accidents. Often the largest number of accidents at an intersection involve left turns. At one very busy intersection, with 91 accidents, 30 involved left-turning vehicles directly, and 18 were rear-end collisions, some, at least, being caused indirectly by the left-turning movements. At this intersection the left turns were prohibited and this resulted not only in reducing accidents, but in marked speeding-up of street cars through the intersection. The change produced no noticable bad effects at near-by intersections.

CLASS G—Various types of accidents. There are many busy intersections which seem to have no definite characteristics except general cussedness. Sometimes a dozen or more different types of accidents will occur in a year, with none particularly outstanding in number of occurrences. This may mean a combination of turning street cars and busses, heavily loaded and slow-moving trucks, a large number of pedestrians, and poor lighting, with perhaps a jog in the street and a safety-zone or other obstruction thrown in for good measure, or some similar combination of difficulties.

Summary

The points which I have tried to bring out in this discussion are that the intersections with the largest number of accidents are not necessarily the most hazardous, that those with the largest ratio of accidents-to-traffic volume are most likely to have some remediable hazards, that troublesome intersections have different "traffic diseases" with recognizable symptoms, and that each symptom indicates the need for a definite remedy. Also that the location of fatal accidents are usually a matter of chance.

Of course, this is an old story to traffic engineers with years of experience, but the problems can be rather

baffling to men who are confronted with them for the first time. To these men I would add the suggestion that the policeman who nurses an intersection day after day can tell you a lot about it that may not be evident either from the accident records or from a casual inspection in the field.

HYDRAULICALLY OPERATED DIVIDERS ADJUST LANES TO TRAFFIC FLOW

by OTTO K. JELINEK

HYDRAULICALLY operated dividers—divisional fins—are especially worthy of note because a 170-foot width of drive would have been necessary in place of the 100-foot now under construction, in the Chicago Park District, had the fins not been adopted. The estimated savings in right-of-way value alone run into large figures; but saving the costs of additional paving, structures, lighting, maintenance, and the elimination of operating difficulties, amounted to twice the cost of the fins.

The movable dividers on the 2.2-mile through drive consist of three parallel lines of fins running longitudinally in the roadway and arranged so that by raising and lowering the lines of fins the roadway can be arranged in several combinations of traffic lanes. Each line of fin consists of a series of movable fin-units set in a trench. Each unit is a structural steel box approximately 20 inches wide, 16 inches deep and 25 feet long. In the lowered position its top is flush with the roadway surface. By means of hydraulic jacks and the hydraulic pressure system, these fins will be raised to project 8 inches above the roadway surface, thus producing a continuous barrier between traffic lanes. Return of the fin to the lowered position is accomplished by the release of the hydraulic pressure and by the action of springs.

In operating this system, the up position of the fin depends upon the density and direction of traffic during the various periods of the day. In the morning rush hours, when the traffic flow is toward the central business district, the east line of fins is raised thereby separating the roadway into six lanes for southbound traffic and two lanes for northbound traffic. In the evening rush period, when the prevailing traffic is away from the central business district, the west line of fins is raised, thereby separating the roadway into six lanes for northbound traffic and two lanes for southbound traffic. Between the morning and evening rush hours, when there is an even balance of flows, the center line of fins is raised in order to separate the roadway into equal parts. The raising and the lowering of the fins is controlled by the operation of switches from the control boxes which are located at the two extremities of the system.

The fin itself is made of ordinary ½-inch structural steel, finished by a process, having aluminum painted federal yellow on the sides and unpainted zinc on all other metal surfaces. The sides are further equipped with bull's-eye type lighted lenses so that the fin may be identified in the up position at night. The wearing surface is of white concrete, 3½ inches thick and reinforced with mesh.

The principal use of this device will be on an avenue having restricted right-of-way and carrying directional traffic to and from the central business district. This type of divider or fin may be used either on surface or on elevated or depressed super-highways. Various possible treatments have been worked out to allow turn move-

ments on surface routes that serve to reduce and simplify the total number of interferences possible under present-day turning methods. It thus has a potential use when the horse-and-buggy street patterns of cities are simplified to a new standard of vehicular use.

235. *Condensed from an article by Otto K. Jelinek, Traffic Engineer, Chicago Park District. (Mem. I.T.E.),* AMERICAN CITY, *March 1940, pp. 95, 96.*

CAN WE REGULATE PEDESTRIANS? YES!

by W. A. VANDUZER

IN the matter of pedestrian injuries and deaths, Washington, D. C., once was no different from any other large city. From 1931 to 1938 pedestrian deaths averaged 70.4 per cent of all traffic deaths. About 27 pedestrians were injured to one killed.

Commonly used engineering, education and enforcement practices had failed to reduce pedestrian casualties, so it was evident that stricter measures were necessary. The public seemed receptive to pedestrian regulation, so preliminary studies were started in December, 1938, to see if such regulations were feasible.

After a period of discussion the modified proposals were found agreeable and apparently legal. The new regulations were adopted on February 7, 1939, but it was decided to withhold police enforcement for several weeks to permit the public to become familiar with the changes in the old regulations.

In brief, the new regulations required that " no pedestrian, equestrian or driver of any vehicle shall disobey the instructions of any applicable official traffic sign or signal unless directed to do so by a police officer."

Also, the pedestrians' right-of-way between intersections was made more definite by the statement that " no pedestrian shall use any roadway between intersections when a vehicle is approaching from either direction so as to constitute a hazard for his own safety or use such roadway at any time in a negligent or reckless manner."

At controlled intersections " drivers of vehicles shall yield the right-of-way to pedestrians crossing or those who have started to cross the roadway on a green or go signal." Fines range from $1 to $300 and up to 10 days in jail.

Special studies were made after the new regulations had been in use for several months to see what their effect had been on pedestrian observance of signals and pedestrian accidents and fatalities.

The pedestrian observance counts made at locations outside the congested district disclosed that of those starting on green 15.2 per cent failed to gain the opposite curb before the red came on, and 18.9 per cent suffered interference from motor vehicles.

This would seem to indicate the need for more strict enforcement against the motorists' failure to yield the right-of-way. The high percentage who had to complete their crossings with a red indication against them shows that the usual amber is not a sufficient warning for the comparatively slow pedestrian.

The fact that the amount of interference with pedestrians crossing on a proper signal has not decreased to any extent, seems to indicate that the motorist is not doing his full part in making the new pedestrian protection program a success.

Taken as a whole, the pedestrian observance studies show that this phase of Washington's pedestrian program has shown definite improvement.

These studies reveal that whereas

pedestrian injuries decreased from 1,793 to 1,675, or 6.6 per cent, for the entire city, they decreased from 289 to 252, or 12.8 per cent, for the central district. This would seem to show that stricter enforcement of the new regulations is needed in the outlying areas.

Also, 20 per cent more accidents (other than pedestrian) were reported during the latter 10-month period, as compared with the former. This puts the benefits of the new pedestrian regulation in a favorable light.

Stricter enforcement of the new regulations as applied to both driver and pedestrian should bring further improvement. Such an enforcement campaign when coupled with the installation of pedestrian signals, crosswalks and islands will put Washington on the path to true pedestrian protection.

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236. *Condensed from an article by W. A. Van Duzer, Director of Vehicles & Traffic, Washington, D. C., (Mem. I.T.E.),* PUBLIC SAFETY, *Feb. 1940, pp.* 22-23, 41

PROGRESS IN STUDY OF MOTOR-VEHICLE PASSING PRACTICES

by O. K. NORMANN

THE first classification of the passing maneuvers was made by separating them into the single- and multiple-passing types. In the single-passing maneuvers, one vehicle passed one other vehicle, while in the multiple-passing maneuvers, two or more vehicles either passed or were passed by one or more vehicles. At an hourly traffic volume of 200 vehicles, 35 per cent of the total passings were accomplished by multiple maneuvers. At traffic volumes above 450 vehicles per hour, this figure exceeds 60 per cent.

Table 2 shows that in 55 per cent of the passings the passed vehicle was traveling from 31 to 40 miles per hour. The speeds of the passed vehicles in nearly all of the remaining passings were almost equally distributed between the 21 through 30 and 41 through 50 mile-per-hour groups.

This table also shows that 51.4 per cent of the drivers that passed desired to travel less than 11 miles per hour faster than the passed vehicle and that the desired speed of 21.2 per cent was less than 6 miles per hour faster. Beside showing the frequency distribution of the speeds of passed vehicles, these data indicate that drivers desiring to travel at a slightly higher speed than the vehicle ahead would rather pass the preceding vehicle when the opportunity presents itself than reduce their speed slightly and stay behind.

TABLE 2.—*Single passings classified by the speed of the passed vehicle and the desired speed of the passing vehicle*

Desired speed of passing vehicle in miles per hour faster than speed of passed vehicle	Speed of passed vehicle in miles per hour					
	20 and under	21–30	31–40	41–50	Over 50	Total
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
5 and under	.....	1.9	11.2	7.8	0.3	21.2
6–10	.....	4.0	18.8	7.1	.3	30.2
11–15	0.4	6.7	17.6	5.5	.3	30.5
16–20	.7	5.0	5.7	.8	.....	12.2
21–30	.3	2.9	1.6	.3	.1	5.2
Over 30	.3	.2	.1	.1	.....	.7
Total	1.7	20.7	55.0	21.6	1.0	100.0
Average difference in speed between passed and passing vehicle (miles per hour)						
	20.6	14.2	10.5	8.6	11.1	10.9

Of all the drivers that were able to accomplish single passing maneuvers on the study sections, table 3 shows that 84.4 per cent had to slow down before they could start to pass; 53.7 per cent slowed down to practically the same speed as the vehicle they were going to pass, and 16 per cent slowed down to within 5 miles per hour of the speed of the vehicle they were going to pass. About one-third had to slow down and stay behind the preceding vehicle until they could see that the road was clear for a sufficient distance ahead to permit them to pass,

and 50.9 per cent had to slow down and wait for an oncoming vehicle to pass before they could start the passing maneuver. The other 15.6 per cent were not required to slow down prior to starting the maneuver. They may have had to slow down after completing the maneuver but they started the maneuver at their normal speed.

When the drivers of the passing vehicles had completed the passing maneuvers and returned to the right-hand lane, table 4 shows that the left lane was clear for a distance of less than 500 feet in 27 per cent of the passings and that there was an oncoming vehicle less than 500 feet away in 16.8 percent of the passings.

TABLE 3.—*Percentage of vehicles making single-passing maneuvers that were delayed before starting to pass (average traffic volume 375 vehicles per hour)*

	Delayed by insufficient sight distance	Delayed by oncoming vehicle	Total
	Percent	*Percent*	*Percent*
Slowed down to same speed as vehicle to be passed	18.0	35.7	53.7
Slowed down to within 5 miles per hour of the speed of the vehicle to be passed	6.6	9.4	16.0
Slowed down, but not to within 5 miles per hour of speed of vehicle to be passed	8.9	5.8	14.7
Total delayed in starting maneuver	33.5	50.9	84.4
Total not delayed in starting maneuver			15.6
			100.0

TABLE 4.—*Distance that drivers of passing vehicles could see that left lane was clear at the time the passing maneuver was completed (average traffic volume 375 vehicles per hour)*

Distance that left lane was clear (feet)	Sight distance limiting factor	Oncoming car in view	Total
	Percent	*Percent*	*Percent*
Less than 500	10.2	16.8	27.0
500 to 1,000	19.0	16.0	35.0
Over 1,000	30.5	7.5	38.0
Total	59.7	40.3	100.0

237. *Condensed from an article by O. K. Normann, Associate Highway Economist, Division of Highway Transport, Public Roads Administration.* PUBLIC ROADS, *Feb. 1940, pp. 221-227, 237-238.*

DESIGN OF MEDIAN STRIPS

IN 1939 a study of the possibilities of rational design was reported by a committee of the Association of State Highway Officials. The determinations, which are too recent to be reflected in past practice, give the future designer his first rational data on median strip width.

In the committee study, highways were divided into three classes as regards character of traffic: *P* denotes highways on which the traffic is exclusively passenger vehicles or the character and percenter of trucks using the highway have little effect on the movement of passenger vehicles; *T* denotes highways on which the percentage of trucks is so high and the character of truck traffic is such that the speed of traffic is reduced frequently and passenger vehicles are confronted with the problem of passing slower-moving vehicles; and *M* denoted mixed traffic in which slow-moving vehicles impede traffic only occasionally. Most highways are in the *M* class.

Omitting all reasoning leading to conclusions, the actual figures are as follows: The desirable width of median strip at grade crossings is at least 25 ft. for *P* traffic, 32 ft. for *M* traffic, and 43 ft. for *T* traffic. The proper lengths of opening in combination with these widths are 67 ft., 98 ft., and 87 ft., respectively. Compromise lengths of opening in combination with these widths are 50 ft., 78 ft., and 67 ft., respectively. These widths combined with proper lengths of opening provide full protection for all crossing and all left-turning vehicles, and accommodate nearly all U-turning vehicles. The accasional heavy unit U-turning vehicle on a four-lane divided highway may have to use the shoulders.

Where the desirable widths of median strip cannot be obtained the median widths may be reduced to 19 ft. for *P* traffic and to 30 ft. for *M* and

T traffic without a material sacrifice in protective features. These widths of median strip combined with proper lengths of opening provide full protection for crossing vehicles in the opened area, but vehicles which turn left onto the divided highway must begin the turn in the face of opposing crossroad traffic before reaching a protected position in the median area. The proper lengths of openings in combination with narrow strips are 73 ft. and 100 ft., respectively. Compromise lengths of opening in combination with these widths have been set at 56 feet., and 80 ft., respectively.

While widths of median strips less than 19 ft. and 30 ft. for *P* and *T* traffic, respectively, will not afford full protection for cross traffic, these narrow widths in combination with proper lengths of median opening may be utilized to afford full protection for left-turning movements.

238. *Condensed from a staff article.* ENGINEERING NEWS-RECORD, *Feb.* 29, 1940, *pp.* 48-51.

LIGHT REFLECTING CHARACTERISTICS OF PAVEMENT SURFACES

by G. S. PAXSON AND J. D. EVERSON

IT was the purpose of the investigation reported herein to ascertain the major characteristics of pavement surfaces which effect the reflection of light and to attempt an evaluation of them. The tests were made on nine road surfaces which are thought to be representative of the range of surface textures generally encountered. These pavment surfaces were: smooth worn portland cement concrete; new portland cement concrete, lightly broomed; new portland cement concrete, medium broomed; ribbed (or grooved) portland cement concrete; smooth asphalt; worn asphaltic concrete; closed-type asphaltic concrete; open-type asphaltic concrete and oiled macadam.

The tests were made by directing a beam of light onto the pavement surface and measuring the intensity of reflected light. The light was directed onto the pavement surfaces at three incident angles, 45 deg., 17 deg., and 2 deg. 45 min. The last angle corresponds to the reflected light from an automobile headlight at a distance of 130 ft. In the 45 deg. and 17 deg. tests the intensity of reflection was measured at intervals of 15 deg. around a 180 deg. arc in the plane of the incident beam. For the low angle test a single measurement was made along the line of specular reflection. The light source for the 45 deg. and 17 deg. tests was a spot light mounted on a tripod, for the low angle test a headlight was used. Tests were made with the surfaces dry and again after they had been wetted.

On dry pavements very little specular reflection or glare was found from any of the pavement surfaces. The portland cement concrete pavements gave a practically uniform reflection in every direction. The asphaltic pavements showed a slight tendency toward a more intense reflection away from the light source than toward it. This was possibly due to the coating of glistening asphalt on the aggregate particles. In general, the portland cement concrete pavements are about four times more luminous than the darker asphaltic pavements. The rough and irregular bituminous macadam surface reflected more light back toward the source than away from it.

When these surfaces become wet the light reflecting characteristics entirely change. The light reflected away from the source is greatly in excess of the reflection in other directions. This is

most apparent on the smooth textured pavements especially the plain asphalt and worn asphaltic concrete which have practically no luminosity outside the line of specular reflection. The rougher textured broom finish portland cement concretes and the open-type asphaltic concretes give considerably less glare.

Under the low angle incident light comparable to headlight lighting none of the pavement surfaces reflect any great amount of light when dry. When wet the surfaces arrange themselves in the order of the surface textures. The open-type asphaltic concrete and the bituminous macadam give no more glare than when dry and the glare from the broomed portland cement concrete is not objectionable. Some of the smoother pavements reflect 20 times as much light when wet as when dry. In general the glare from wet pavement surface is a function of the ability to drain the water away without flooding the surface.

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239. *Condensed from an article by G. S. Paxson, Bridge Engineer, J. D. Everson, Electrical Engineer, Oregon State Highway Department, Technical Bulletin No. 12.*

SAFE BOULEVARD PLANTING

by CHARLES W. BARR

IF a boulevard with 30-foot roadways and a 24-foot center strip is taken for study, it can be calculated from Table 3 that a motorist stopped in the safety zone of a cross street will take 318 seconds to cross the one strip of roadway under normal acceleration. During the same interval of time a motorist travelling at 50 miles per hour along the main road will have travelled 279 feet.

TABLE 3

TIME RATE AND DISTANCE OF SPEED CHANGE FOR 5 M. P. H.

Normal Acceleration

M.P.H.	Time Seconds	Rate M.H.P. per Second	Distance Feet
0-5	1.7	2.9	6
5-10	2.0	2.5	22
10-15	2.3	2.2	42

Full Acceleration

M.P.H.	Time Seconds	Rate M.H.P. per Second	Distance Feet
0-5	1.3	3.9	5
5-10	1.4	3.6	15
10-15	1.5	3.3	28

Therefore, it is imperative that they can see each other when they are more than 279 feet apart. There are times when it is possible to avoid an accident by causing the faster-moving driver to switch lanes, but that is not safe driving. There is also the possibility of a car stalling before it crosses the pavement, a slower crossing due to ice or poor driving, and other similar events that may make it necessary for the other driver to use his brakes. A car travelling 50 miles an hour will require at least 193 feet in which to stop. This distance is within the necessary sight distance, but does not adequately care for horn-blowing time or winter weather. Therefore, to care for most contingencies, the travel distance of the faster moving motorist and his braking distance should be added together to give the necessary distance for clear vision required by the waiting car in the safety zone. This total is 472 feet.

There are very few boulevard plantings today that permit 472 feet of clear vision, because the trees and shrubs are planted within a central strip of the planting space, and too high-growing shrubs were used in the wrong area near the intersecting streets. It is possible, however, to give adequate vision.

In locating the areas in which shrubs may be placed with safety, the line of sight has been taken 10 feet from the curb intersection so that the driver will not feel required to encroach upon

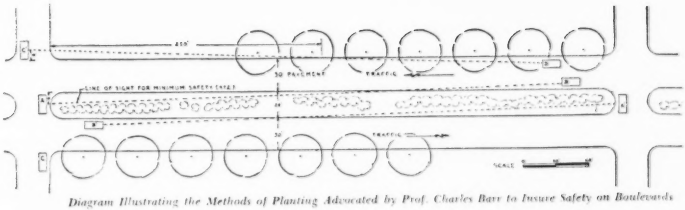

Diagram Illustrating the Methods of Planting Advocated by Prof. Charles Barr to Insure Safety on Boulevards

the opposing road in order to see, and a minimum strip of 5 feet is allotted for grass next to the curb of the central division strip. It is then seen that the planting area goes in a diagonal across the 500-foot strip. The line of sight between cars A and B, A′ and B′, should be kept entirely free. At first glance it may seem that such a scheme eliminates the possibility of the usual semi-informal style of planting, but if two blocks are taken into consideration, it will be seen that there is a greater opportunity to avoid the straight-line planting.

The problems of plant arrangement and selection are much simpler with the foregoing plan, as there is no worry about plants growing too tall and causing accidents if the maintenance crew doesn't get around to cutting their heads off soon enough. The chief thing to avoid is an opening in the planting that is large enough to encourage the driver of car C, with a sense of false security, to cross the safety zone without stopping. For the same reason it seems that the shrubs near the intersection should be tall, for a driver will obey a stop sign quicker if he can't see the traffic until he reaches the required point.

It is also important that drivers in the position of C′ have their vision clear. To do this, there should be no shrub planting near the curb for the first 250 feet. The matter of trees within that area is a debatable question. If trees are used, they should be high-branching and spaced far enough apart to prevent the trunks from lining up and making blind areas as they near maturity. It would be very much better if the trees were placed in the front lawn area, 10 feet back from the curb.

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240. *Condensed from an article by Charles W. Barr, Assistant Professor of Landscape Architecture, Michigan State College.* AMERICAN CITY, *March 1940, pp. 73-75.*

ADEQUATE STREET TRAFFIC SIGNS

by JAMES S. BURCH

ONE major way to improve the driver is to inform and guide him; and make it easy for him to do the proper thing. To guide him, it is necessary that we understand as much as possible his psychology and his reactions. We cannot simply hold up a hoop and expect all drivers to jump through it. Let's look then at some of the major traits of the "collective" driver which are generally accepted as being true.

The driver's purpose is to arrive at his destination, and in the absence of restraint, he can be depended upon to drive at the maximum speed consistent with comfort, and his subconscious appraisal of safety. More

than anything else, he dislikes delay, and is irritated by having to wait.

But few drivers employ their conscious minds continuously when driving, most of their actions and observations being automatic, or controlled by the subconscious. The driver is a creature of habit and, if his habits are properly directed and developed, this property is our greatest asset.

The driver is lazy, and follows the line of least resistance (he objects to using the brakes, the gear shift lever and the steering wheel). The driver is extremely dangerous when surprised, confused, or irritated; and tends to lose all sense of physical values, and may react in an erratic way under such conditions.

On the other hand, the driver is surprisingly competent and skilled in operating the motor vehicle; records showing that about 98% of the drivers are normally efficient.

Our greatest driver asset, insofar as the traffic authorities are concerned, is the fact that he will obey reasonable restrictions; will do so consistently, and will develop the excellent habit of obeying all restrictions automatically and instinctively; provided these restrictions are reasonable, necessary, simple and consistent.

The major properties of a good sign are:

1. Visibility; proper position, size, color combination and illumination in dusk and dark conditions.

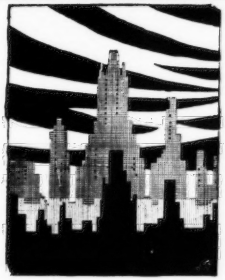
2. Simplicity; the fewest possible number of short words or symbols, quickly and easily understood by all drivers.

3. Uniformity; identical signs for identical situations, regardless of where these situations may occur; consistent positions, standard shapes, sizes, colorings and legends.

Because of the increased speed on our highways, we have already started the use of oversize signs and letters in special cases, and it is probable that this policy will have to be extended materially in the years to come. For instance, at a 60 mile speed, tests have shown that letters of less than 6″ height cannot be read by a driver within his gross braking distance in daylight, or less than 8″ letters at night. A rule-of-thumb rule is about 50 feet of legibility distance in daylight for each inch of letter height, using wide series D letters (Forbes-Holmes, Yale).

All conflicting privately owned signs should be discouraged and removed. Special trouble is noted in this respect around filling stations, curb service stores, etc. We have sometimes noticed a sign out on the curb, reading " Stop for Joe's Weiners " in standard shapes and colors. Quite often, city officials put up conflicting signs, I have seen a Stop sign at an intersection with a Stop and Go light; and, when the light is green, the driver must either disobey the Stop sign, or the green light. We have seen cases where there are no speed limit signs whatever inside the town, but when the driver approaches the rural section, he will encounter a sign reading, " Speed Limit 25 M. P. H."

241. *Condensed from an article by James S. Burch, Engineer of Statistics and Planning, North Carolina State Highway Commission, presented at the "Short Course for Superintendents and Assistants," Raleigh, N. C., Feb. 14, 1940., mimo. 8 pp.*



Traffic Engineering NEWS

This issue of TRAFFIC ENGINEERING marks another step in the Institute's program to increase the value of this publication.

Three distinct features of the publication in its printed form are worthy of note:

1. The number of pages has been increased making it possible to lengthen the abstracts so that, in most cases, it will be unnecessary to refer to the original article.
2. A feature story will appear monthly. These articles, specially prepared for TRAFFIC ENGINEERING will be selected because of their particular application to current traffic engineering problems.
3. Approximately four pages of advertising will be carried in each issue.

In its new and more attractive form, the Institute anticipates an increase in circulation and plans to expand and improve the magazine as rapidly as may be warranted.

The Editor

Annual New York Dinner

Plans for the annual dinner of traffic engineers in the eastern region have just been announced by a special committee under the chairmanship of John Gibala.

The dinner will be held in the Banquet Room, Hotel Pennsylvania, Wednesday, April 17, at 6:30 P. M., during the 11th Annual Greater New York Safety Convention.

In lieu of a formal speaker as in past years, there will be a special showing of the moving picture winning the Commercial Investment Trust Safety Foundation plaque for the outstanding commercial film on traffic safety produced during 1939. The winning pic-

ture is selected annually by the Motion Picture Traffic Safety Committee of which Dr. Miller McClintock, Mem. I.T.E., is chairman, and Dwight Mc Cracken, Mem. I.T.E., is secretary.

Prior to the showing of the film, Dr. McClintock will speak briefly on the purposes and objectives of the committee. John W. Darr, vice-president, Commercial Investment Trust, Inc., and Director, C. I. T. Safety Foundation will award the plaque.

Presiding at the dinner will be Hawley S. Simpson, President, Institute of Traffic Engineers.

Reservations are strictly limited to the seating capacity of the Banquet Room, 300, and it is urged that they be made at once to Secretary Hammond.

Tickets are $2.75 per plate including tax.

A cordial invitation to attend is extended to all who are interested in any phase of the traffic problem.

Don't forget the ladies when making reservation; they will be doubly welcome.

Greater New York Safety Convention

Don't forget the six traffic sessions during the Eleventh Annual Conference of the Greater New York Safety Council in the Hotel Pennsylvania, April 16, 17, and 18. W. Graham Cole, Mem. I.T.E., is Chairman of the Executive Committee in charge of the convention.

Outstanding speakers at the sessions on traffic enforcement, bicycles, community safety and traffic accident investigation, arranged by a committee under the chairmanship of Profesor Lawrence E. Tipton, Affil. Mem.I.T.E., will discuss subjects of real interest to all concerned in traffic problems.

To traffic engineers the most important session will be that on April 17 at 2:00 P. M., on Municipal Traffic Engineering. Sponsored by the Institute of Traffic Engineers, and arranged by a committee under the chairmanship of John T. Gibala, who will preside at the session. It is expected to reach a record attendance peak. Speakers are Commissioner Lawrence M. Orton, New York City Planning Commission; New York City Councilman Robert K. Straus; and Theodore M. Matson of the Bureau for Street Traffic Research.

Midwest Safety Conference

The Eighteenth Annual Midwest Safety Conference will be held again in Chicago on April 30, May 1 and 2 at the Sherman Hotel.

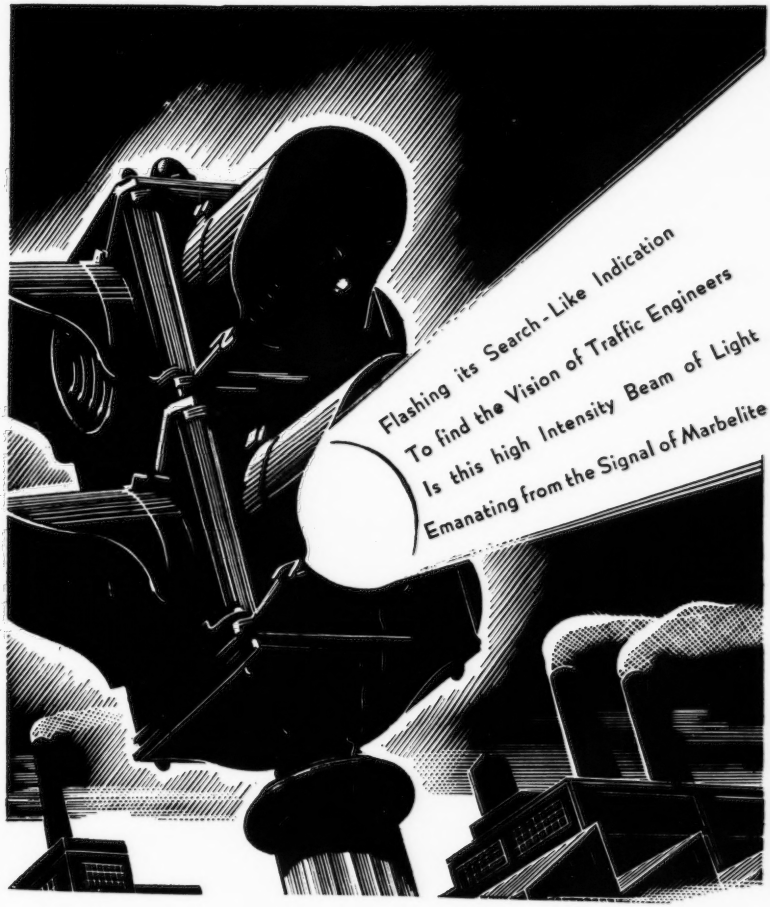
The Executive Committee of the Midwest Safety Conference invited the Institute of Traffic Engineers to become joint sponsors of the Conference and to take charge of the development of program for the Public Safety Sessions. President Simpson appointed Leslie J. Sorenson to represent the Institute on the Sponsoring Committee and William R. Abbott, Jr., as Chairman of the Program Committee. Both Mr. Sorenson and Mr. Abbott are members of the Executive Committee of the Midwest Safety Conference.

An excellent program has been developed in the three public safety sessions:

PUBLIC SAFETY—Education
Tuesday, April 30, 1940
2:00 P. M.
Bal Tabarin—Sixth Floor
Presiding: Marion Telford

1. "Safety Needs Publicity"—Paul Jones
2. "Public Safety Education in the Schools"—Ray C. Soliday

PUBLIC SAFETY—Enforcement
Wednesday, May 1, 1940
9:30 A. M.
Bal Tabarin—Sixth Floor
Presiding: James B. Kerr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1939 PROCEEDINGS

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1. A comprehensive discussion of enforcement as related to the functions of police departments by Lieut. Franklin M. Kreml. Lieut. Kreml will be assisted by A. R. Forster.

PUBLIC SAFETY—Engineering
Thursday, May 2, 1940
2:00 P. M.
Bal Tabarin—Sixth Floor
Presiding: The Honorable George D. Kells

1. "Building Streets for Safety"—The Honorable Phillip T. Harrington
2. "Lighting Streets for Safety"—L. J. Schrenk

There will be several get-together sessions for Institute members who are attending the convention and it is hoped that several business meetings can also be conducted at this time. All members of the Institute are urged by President Simpson to attend this Conference.

Houston, Texas

The City of Houston, Texas, through its Mayor and City Commissioners, has established a Traffic Engineering Department which will begin to function April 1. Tom Willier, formerly with the Traffic Audit Bureau, has been appointed as Traffic Engineer and Director of the Traffic Engineering Bureau. Mr. Willier has been making Houston his headquarters for the past two years although his work with the Traffic Audit Bureau had carried him over a large section of the country.

The Traffic Engineering Bureau, established by City Ordinance, will include not only a director but an assistant, a secretary, a draftsman, an edu-

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Traficounter

WHAT IT IS — The Traficounter is a device which automatically counts vehicles.

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USED — to determine vehicular volume, at both permanent and temporary stations.

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cational director and public relations man, three part time assistants for traffic counting, etc., and the signs and markings men who are to be moved from the Police Department to the Traffic Engineering Bureau.

The Institute wishes Tom Willier the best of luck in his new job. The members stand ready to be of assistance to him in every way possible.

For Traffic Engineering

Member E. J. (Wrong-Way) O' Meara is seeking information on the rate of deceleration of standard passenger cars under the braking effect of engine compression and friction only. Reason: The Wisconsin State Legislature recently passed a law requiring speed zoning of highways approaching cities. As Mr. O'Meara points out, it would be a mistake to require progressively slower speeds within such short distances that brakes would have to be applied to conform to the signed speeds.

Mr. O'Meara used the following novel method of determining distance covered while a Ford V-8 was decelerating from 60 M.P.H. to 50, to 40, and finally to 30 M.P.H.: At 60 M.P.H. on straight, level pavement, the accelerator was released and an egg slammed on the pavement. When the speedometer read 50, another was let fly, and two more went at 40 and 30 M.P.H.*

The average distance covered during each step of deceleration was found, by several tests, to be:

60 to 50 miles per hour 492 feet
50 to 40 miles per hour 442 feet
40 to 30 miles per hour 388 feet

Verifications of these findings, or additional data, are requested from all

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readers who may have made similar investigations.

* EDITOR'S NOTE: It is fortunate for Wisconsin pedestrians that ostriches are not native to the Badger State.

Highway Traffic Control

Mr. William Phelps Eno, Honorary Member I.T.E., has just published a new book entitled, *The Story of Highway Traffic Control; 1899-1939.*

The book is a thorough-going, detailed and documented review of Mr. Eno's many activities, both in the United States and abroad, in the furtherance of better highway traffic regulation and promotion of greater highway safety.

The author is the founder and Chairman of the Board of the Eno Foundation for Highway Traffic Control, Inc., which has recently constructed, in Saugatuck, Connecticut, a beautiful Colonial building. This is the only building in the world devoted exclusively to highway traffic control.

Copies of the book may be purchased from the Eno Foundation for Highway Traffic Control, Inc., Saugatuck, Connecticut, at $4.00 per copy. Reduced prices will be quoted on orders from police departments, traffic engineering schools and other organizations in the traffic field.

Traffic Engineer for Austin, Texas

The Austin, Texas, Safety Council has announced that the City of Austin will hire a traffic engineer in the near future. The traffic engineer will be located in the Police Department.

A. S. P. O.

The American Society of Planning Officials' Committee on Highways and Transportation is directed by the Society to consider the whole subject of Highway, Mass Transportation, and Traffic in and around cities and the design, location and function of such facilities with relation to each other and other planned development, particularly the use of abutting property and the rehabilitation of blighted areas.

Recently appointed to this committee of five are four Institute members: Burton W. Marsh, D. Grant Mickle, Ladislas Segoe, and I. S. Shattuck.

For Traffic Engineering

Joe Feuchter, Traffic Engineer of St. Louis, has submitted interesting evidence that traffic engineering in his city dates back to 1913. In that year Mr. C. M. Talbert, Director of the Department of Streets, made several traffic counts which he later compared graphically with counts made in 1914 and again in 1915. Those counts tended to show that the horseless carriage was on its way to oblivion, although that conclusion was not drawn by Mr. Talbert. The highest recorded volume of vehicular traffic in those days at mid-block points along principal thoroughfares was considerably less than 500 vehicles for nine consecutive hours. This is for both directions and not *per hour*, but for the total business day.

Michigan Highway Conference

At the 25th Anniversary Highway Conference held at the University of Michigan, February 14 to 16, the following papers were presented by I.T.E. members:

"The Functions of the Michigan State Highway Department Traffic and Safety Division" — D. Grant Mickle

"The Functions of the Michigan State Police Safety and Traffic Division"—Oscar M. Gunderson

"Pedestrian Protection" — Burton W. Marsh

XU